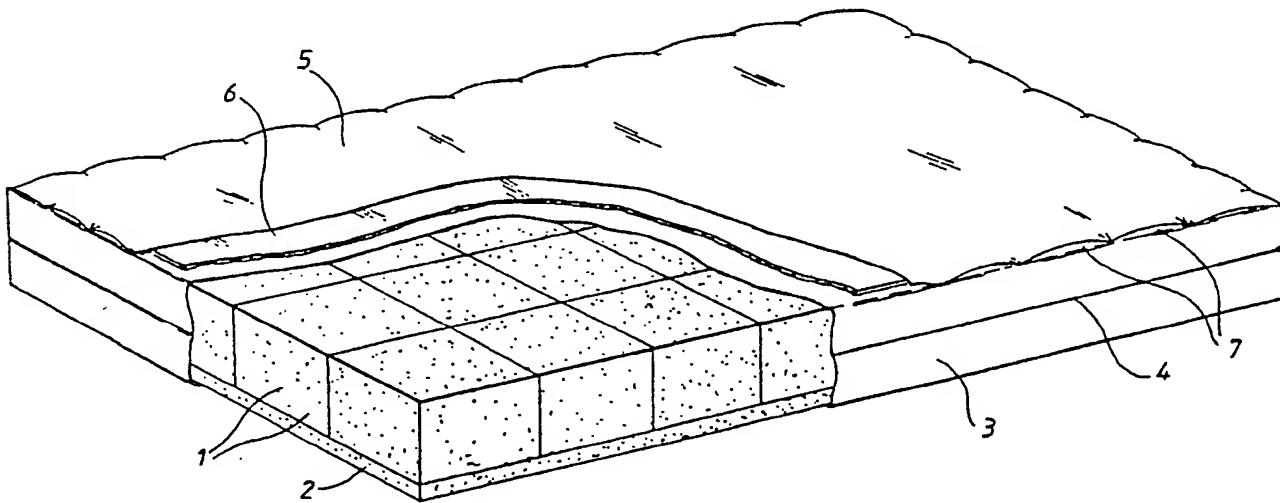




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: MATTRESS



(57) Abstract

A mattress intended primarily for orthopaedic use has a foam interior comprising a number of interchangeable foam blocks (1) of different hardnesses. The blocks are held in position relative to each other by a closely fitting removable flexible cover (3). The hardness characteristics of the mattress can be altered to suit a variety of different patient conditions by selecting the blocks (1) from a wide range of hardnesses and arranging them in a predetermined pattern to obtain the required hardness distribution.

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"Mattress"

This invention relates to a foam mattress intended particularly for orthopaedic use.

It is known that people suffering from back injury or from the after effects of such an injury require mattresses with different characteristics depending on, for example, the dimensions and weight distribution of the particular patient, on the position in which the patient feels most comfortable, and on the advice given by medical practitioners. Attempts

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to produce a mattress which meets this requirement have had limited success; a known mattress has springs of differing spring rates in different areas of the  
5 mattress but this mattress does not exhibit the required differential resilience along its length and width. It is also known to introduce sections of board inside the middle of a mattress to increase the hardness in a selected area, but this has similar  
10 disadvantages. Neither construction allows the resilience to be adjusted according to the particular requirements of each individual patient.

Foam has commonly been used as a material for both non-orthopaedic and orthopaedic mattresses. It is also known to reduce the hardness of a foam mattress by making perforations which extend through the mattress from top to bottom, but such a mattress can only be made to suit some patients and cannot be altered to suit others.  
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It is an object of this invention to provide  
20 a mattress which has adjustable resilience and which is relatively cheap and simple to manufacture.

According to this invention there is provided a mattress comprising an internal body of plastics foam material and a flexible cover surrounding the body,  
25 wherein the body includes a plurality of foam sections of at least two different hardnesses, the cover being removable to allow foam sections to be replaced thereby to alter the hardness characteristics of the mattress.



In a preferred embodiment of the invention the foam sections are cuboid or cubic blocks of different hardnesses which are arranged on a foam base layer to produce a rectangular mattress interior with the required distribution of relatively hard and relatively soft areas. The blocks are interchangeable so that the arrangement can be altered to suit various different patients. The cover fits closely around the internal foam body to hold the blocks in abutting relationship. Since the majority of orthopaedic applications of the mattress require variations in hardness along the length of the mattress rather than across the width, it has been found convenient to subdivide the interior lengthwise using elongate cuboid blocks arranged side by side transversely of the mattress. Best control over the distribution of hardness across the mattress is obtained if the mattress is supported on a flat rigid base. Similar hardness characteristics can be produced in an alternative construction in accordance with the invention, by forming the mattress interior from a main foam section and several insert sections which are fitted in voids in the main section. Alteration of the mattress characteristics is carried out by removing the cover, removing selected insert sections from the main section and replacing them with insert sections of different hardnesses.

The invention will now be described by way of example with reference to the drawings in which:-



Fig. 1 is a perspective view of a first mattress in accordance with the invention with a portion of the cover cut away to show the interior;

5 Figs. 2a and 2b are diagrammatic plan views of the interior of the mattress for two different patient conditions;

Fig. 2c is a key to the symbols used in Figs. 2a and 2b;

10 Fig. 3 is a diagrammatic plan view of a mattress interior comprising elongate foam blocks;

Fig. 4 is a cut-away perspective view of an alternative mattress interior; and

Fig. 5 is a cut-away perspective view of a further alternative mattress interior.

15 Referring to Figure 1, a first embodiment of mattress in accordance with the invention has an internal body of foam material comprising a plurality of foam blocks 1 laid on a soft foam base layer 2. The blocks are approximately 150 mm square by 120 mm thick, and  
20 are made of fire retardant polyether foam with a maximum closed cell and minimum open cell arrangement. The blocks are of different hardnesses and may be colour coded for easy identification. Hardness of the foam blocks may be expressed in terms of an indentation hardness index  
25 as specified for example in British Standard No. BS4443 (Procedure A), polyether foam being available in different hardnesses with indexes in the range 20N to 180N. In this particular mattress foam blocks in the range 50N to 180N are used in a variety of arrangements depending on the  
30 patient condition. If firmer blocks are required, re-constituted foam having a hardness index of 340N to 380N may be used.



5           The base layer 2 is approximately 25 mm thick and extends over the whole area of the mattress. A similar upper soft foam layer (not shown) may be placed over the blocks 1 to reduce any discomfort for the patient caused by the edges of adjacent blocks of different hardnesses.

10           The whole internal foam body of the mattress is enclosed in a closely fitting flexible cover 3 of mattress ticking material which holds the blocks 1 in abutting relationship. A zip 4 in the side of the cover 3 is provided for removing the cover if the blocks 1 are to be replaced or cleaned.

15           A further feature of the cover 3 in the embodiment of Figure 1 is a multiple-layer upper portion providing an escape path for moisture accumulated in the cover. The mattress ticking preferably has a waterproof upper surface, and this is covered by an outer sheet 5 of ventile material such as Gore-Tex (Registered Trade Mark) and a sheet 6 of water vapour transmitting material, the latter conducting any accumulated moisture to the edges of the mattress where openings 7 are provided. However, this is but one possible arrangement, and perspiration and incontinence can be dealt with by alternative means such as loose covers which do not form part of the mattress.

20           The embodiment of Figure 1 has square section foam blocks 1. Two exemplary arrangements of these blocks are shown in Figs. 2a and 2b, the relative hardnesses of the blocks being shown by symbols explained in Fig. 2c. Fig. 2a shows a typical arrangement for a



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patient with the following condition: Reduced Anterior-Posterior Curves, Periostitis (both feet) - Calcaneum. The arrangement of Fig. 2b is suitable for a patient with Exaggerated Anterior-Posterior Curves. A feature which is common to both arrangements is the relatively hard side edge portions produced by the rows of firm blocks on either side of the central region of the mattress.

It will be seen from Figs. 2a and 2b that the arrangement of the different hardness blocks is such that the same distribution of hardnesses can be obtained by elongate blocks each equivalent to a row of 4 square section blocks. This is true for the majority of typical arrangements, enabling elongate foam blocks to be used as shown in Figure 3. Three longitudinally placed blocks form hard side edge portions, and a row of transversely placed blocks form a central region which is subdivided lengthwise.

As an alternative to the block construction, a mattress in accordance with the invention may comprise a main body of foam having several voids which are filled by foam insert sections of different hardnesses. Examples of such a mattress are shown in Figs. 4 and 5. The mattress interior shown in Fig. 4 has a main foam section 8 with a series of parallel transversely extending channel voids filled by corresponding shaped removable elongate insert sections 9 of a different hardness or hardnesses. In Figure 4, three of the insert sections are shown partly removed.

Another embodiment is illustrated in Fig. 5, with cylindrical insert sections 10 (some shown partly removed) in corresponding cylindrical voids extending from the bottom face to the top face of the main section 11.

## Claims:

1. A mattress comprising an internal body of plastics foam material and a flexible cover surrounding the body, wherein the body includes a plurality of foam sections of at least two different hardnesses, the cover being removable to allow foam sections to be replaced thereby to alter the hardness characteristics of the mattress.

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2. A mattress according to claim 1, wherein the foam sections comprise a plurality of cuboid foam blocks of different hardnesses arranged in abutting relationship to form a body of rectangular outline which is subdivided lengthwise.

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3. A mattress according to claim 2, wherein the blocks are held in position relative to each other by the cover.

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4. A mattress according to claim 2, wherein the blocks rest on a one-piece foam base layer extending over substantially the whole area of the mattress.

5. A mattress according to claim 2 including a one-piece foam upper layer laid on the blocks.

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6. A mattress according to claim 2 having a central region which comprises a plurality of elongate blocks arranged side by side and transversely of the mattress to provide the said lengthwise subdivision.

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7. A mattress according to claim 2 wherein the blocks include a plurality of relatively hard foam blocks arranged along the longitudinal sides of the mattress to form relatively firm edge portions.
8. A mattress comprising an internal body of foam material and a removable box-shaped cover enclosing the body, wherein the body comprises a main foam section extending substantially the whole length and width of the mattress, and a plurality of foam insert sections of a different hardness from the main section inserted in voids formed in the main section.
9. A mattress according to claim 8 wherein the main section has voids which open out on the upper surface of the mattress, the mattress further including a continuous foam upper layer laid on the upper surface of the main section.
10. A mattress according to claim 9 wherein the insert sections are of elongate configuration and are inserted in transversely extending channels.

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**AMENDED CLAIMS**

(received by the International Bureau on 20 July 1981 (20.07.81))

1. A mattress comprising an internal body of plastics foam material and a flexible cover surrounding the body, wherein the body comprises a plurality of individually formed parallel-sided foam blocks of at least two different foam hardnesses, the blocks being distributed over the area of the mattress with adjacent blocks being held in abutting contact with each other by the cover so as to divide the body longitudinally and transversely into regions of differing resilience, and wherein the cover is removable to allow replacement of the blocks for altering the hardness characteristics of the mattress.
2. A mattress according to claim 1, wherein the foam blocks comprise a plurality of cuboid foam blocks of different hardnesses arranged in abutting relationship to form a body of rectangular outline.
3. A mattress according to claim 1, wherein the blocks rest on a one-piece foam base layer extending over substantially the whole area of the mattress.
4. A mattress according to claim 1 including a one-piece foam upper layer laid on the blocks.
5. A mattress according to claim 2 having a central region which comprises a plurality of elongate blocks arranged side by side and transversely of the mattress to provide the said lengthwise subdivision.



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6. A mattress according to claim 2 wherein the blocks include a plurality of relatively hard foam blocks arranged along the longitudinal sides of the mattress to form relatively firm edge portions.

7. A mattress comprising an internal body of foam material and a removable box-shaped cover enclosing the body, wherein the body comprises a main foam section extending substantially the whole length and width of the mattress, and a plurality of foam insert sections of a different hardness from the main section inserted in voids formed in the main section.

8. A mattress according to claim 7 wherein the main section has voids which open out on the upper surface of the mattress, the mattress further including a continuous foam upper layer laid on the upper surface of the main section.

9. A mattress according to claim 8 wherein the insert sections are of elongate configuration and are inserted in transversely extending channels.



**STATEMENT UNDER ARTICLE 19**

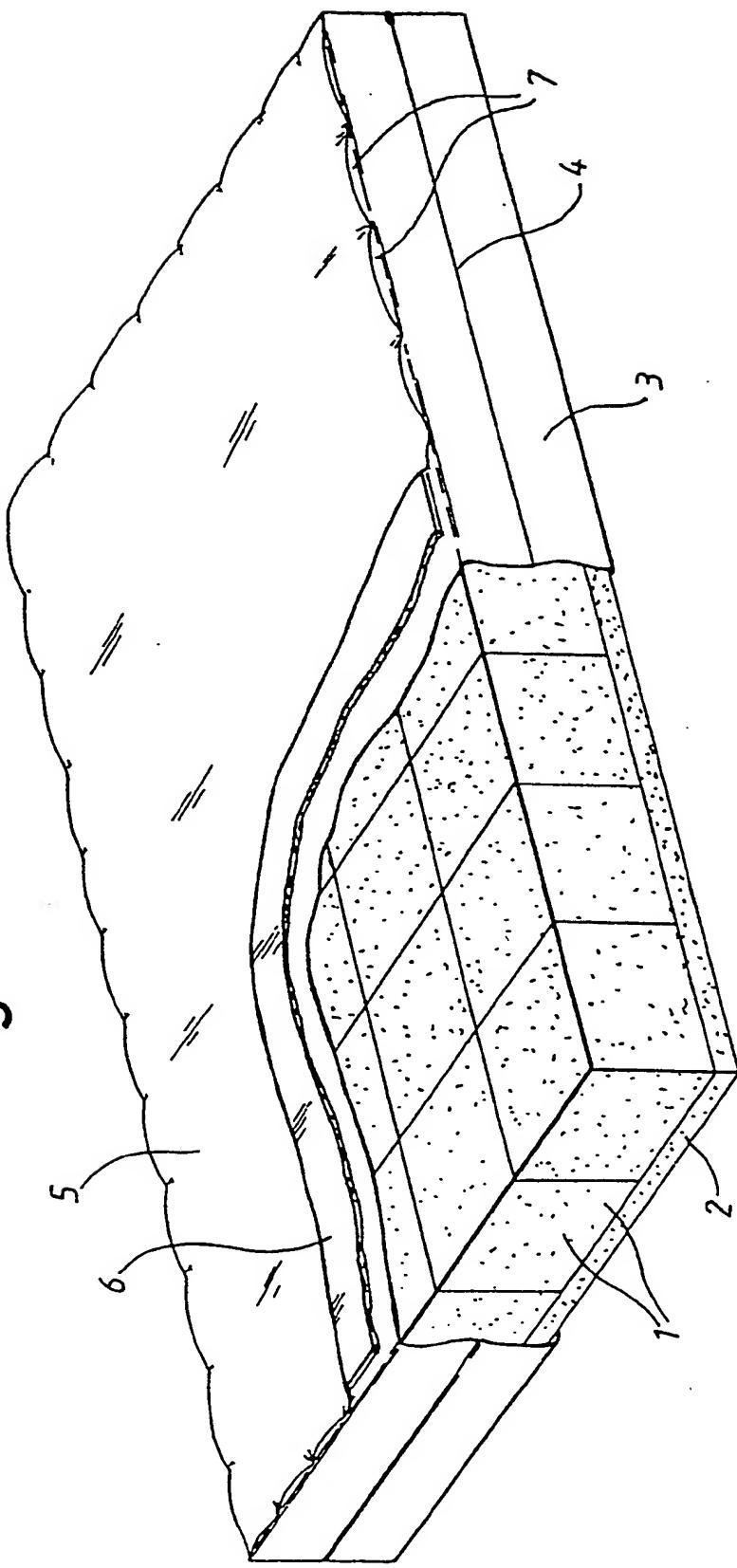
New pages 1 and 2 of the Claims are filed herewith in duplicate to replace existing pages 1 and 2 of the former claims.

In the amendment, claim 1 has been amended to include the limitation to a mattress having a plurality of parallel sided blocks which subdivide the mattress both longitudinally and transversely and which are held in abutting relationship by the removable cover. Former claim 3 has been cancelled and consequential amendments have been made to former claims 2, 4, 5, 6 and 7, now claims 2 to 6. Claims 8 to 10 have been renumbered 7 to 9.

A circular logo containing the word "BUREAU" at the top and "OMP" at the bottom, all in a stylized font.

**Fig.1.**

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BUREAU  
OMI  
WIRO  
AL

HEAD					
	0	0	0	0	
	0	0	0	0	
X	X	X	X		
X	X	X	X		
X	X	X	X		
	0	0	0	0	
	0	0	0	0	
0	0	0	0		
0	0	0	0		

FOOT

Fig.2a.

HEAD					
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
	■	■	■	■	
	■	■	■	■	
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
X	X	X	X		

FOOT

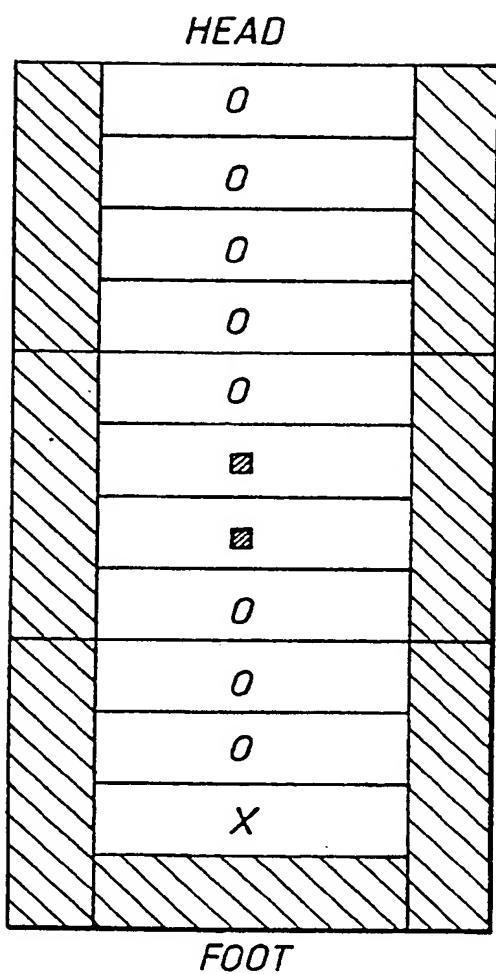
Fig.2b.

X	SOFTEST
0	NEXT SOFTEST
■	FIRMER
▨	FIRMEST

Fig.2c.

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Fig.3.



4/4

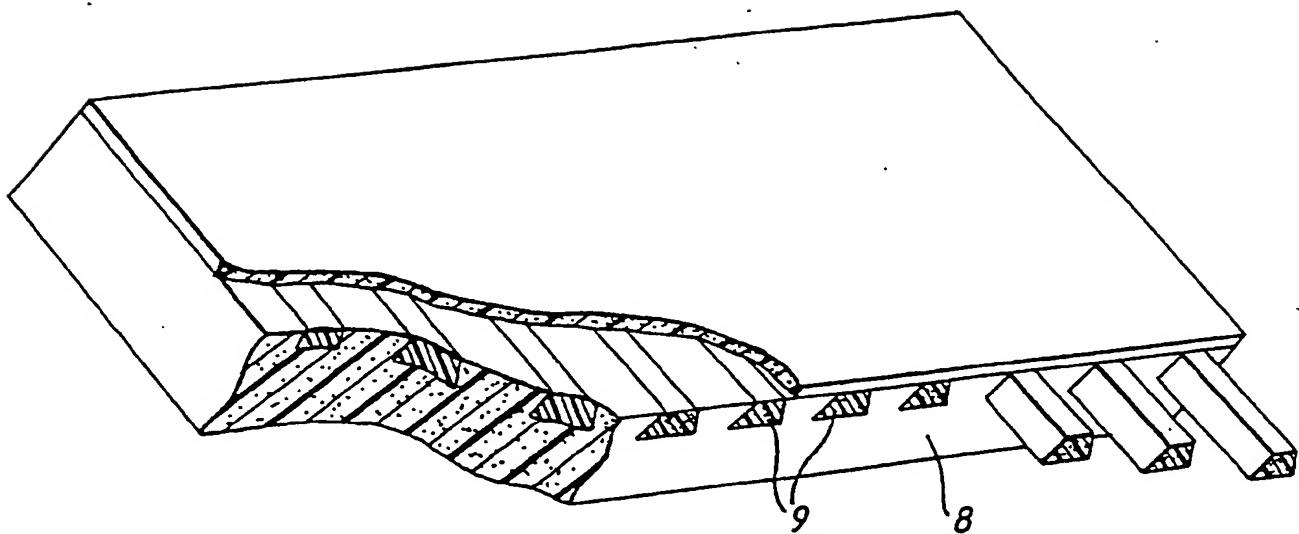


Fig.4.

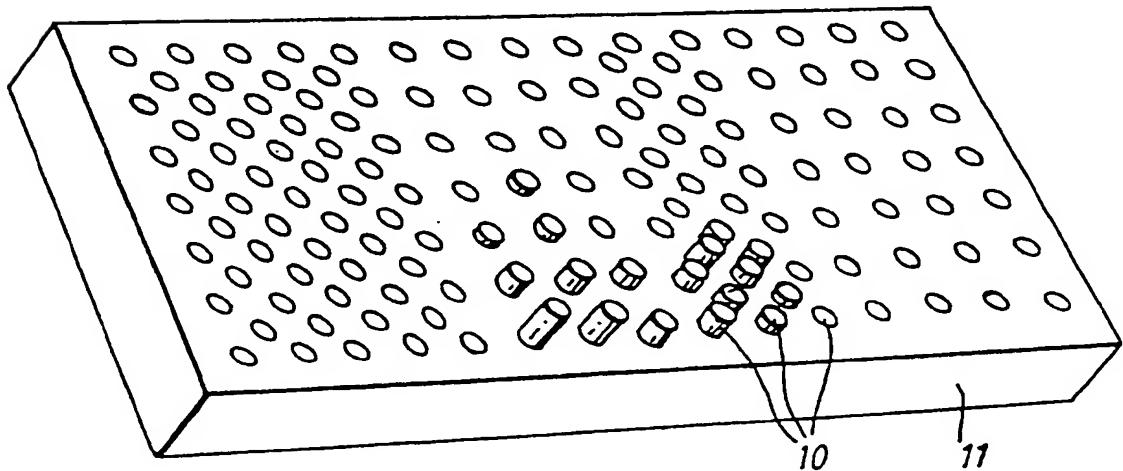


Fig.5.

**I. CLASSIFICATION OF SUBJECT MATTER** (if several classification symbols apply, indicate all) <sup>3</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. <sup>3</sup>: A 47 C 27/00; A 47 C 27/14// A 61 G 7/04**II. FIELDS SEARCHED**Minimum Documentation Searched <sup>4</sup>

Classification System	Classification Symbols
Int.Cl. <sup>3</sup>	A 47 C

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched <sup>3</sup>**III. DOCUMENTS CONSIDERED TO BE RELEVANT** <sup>14</sup>

Category <sup>15</sup>	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>
X	BE, A, 555821, published March 30, 1957, see page 1, paragraphs 7-9 and the figures, Ludlam ---	1, 3, 6
X	FR, A, 1359362, published in 1964, see page 1, column 1, paragraph 8 - column 2, paragraph 2, page 1, column 2, paragraphs 5-7 and the figures, Muller ---	1, 3, 6
	GB, A, 1286299, published August 23, 1972, see page 2, lines 9-40 and the figures, Lenz ---	1, 4, 5, 6, 7, 8, 9, 10
	CH, A, 536616, published June 29, 1973, see page 2, lines 18-33 and the figures, Rolladen-Held -----	2, 4, 8, 9

\* Special categories of cited documents: <sup>19</sup>

"A" document defining the general state of the art

"E" earlier document but published on or after the international filing date

"L" document cited for special reason other than those referred to in the other categories

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but on or after the priority date claimed

"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention

"X" document of particular relevance

**IV. CERTIFICATION**Date of the Actual Completion of the International Search <sup>20</sup>

May 11, 1981

Date of mailing of this International Search Report <sup>21</sup>

May 21, 1981

International Searching Authority <sup>22</sup>  
EUROPEAN PATENT OFFICE Branch at The Hague  
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2280 HV RIJSWIJK (ZH) The NetherlandsSignature of Authorized Officer <sup>23</sup>

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